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THERMOLUMINESCENCE DETECTOR AND METHOD FOR THE PRODUCTION THEREOF

The invention relates to a thermoluminescence detector and a method for the production thereof.

DE 196 43 317 A1 discloses a finger ring dosimeter with thermo-luminescence detectors identified by inscriptions (TL detectors) as they are known from DE 196 43 316 A1. The identification number in the omni-directional DATA-MATRIX-code applied to the detectors (ϕ3.9 x 1 mm^3) must be read for an allocation of the individual calibration factor for each individual detector for determining the dose.

Up to now the detectors have been marked by expensive procedures, for example by laser imprinted heat resistant foils, which were connected to the detector crystals by means of cement. With this known method, at times, the foil extended beyond the detector surface area with the result that these detectors can be evaluated only in special measuring apparatus.

The detectors marked in this way can be efficiently manufactured in large numbers only with high machinery expenses.

Other direct imprinting methods which utilize color change reactions as they are known for example from EP 0 190 997 A cannot be used because the detectors must be repeatedly heated for erasing whereby the markings are detrimentally affected or they disappear altogether. To what degree the measuring signal is affected thereby is not known.

Methods and equipment by which large numbers of detectors can be manufactured automatically and at low costs are commercially not available.

It is therefore the object of to provide a detector and a method for a direct inscription of the detector which forms a heat resistant durable characterization of the detector and the detector can be marked by simple means by standard laser inscription systems also in large manufacturing series.

The object is solved by the features of the patent claims 1 and 4. The sub-claims define advantageous embodiments of the invention.

Below the invention will be described in greater detail on the basis of the drawings.

Herein Fig. 1 shows a retaining structure for supporting detectors. Fig. 2 and 3 show a top view and, respectively, a side view of a detector.

The retaining structure shown in Fig. 1 as sectional view consists essentially of a cover plate 1 and a base plate 3, between which the detectors 2 are supported in a regular two-dimensional arrangement. The detectors 2 are fixed in bores with centering rings in the cover plate 1, and the two plates are interconnected by means of mounting screws 4. The centering ring is about 0.25 mm wide and about 0.25 mm high. On top of each detector 2, there is an upwardly opening funnel. By way of this funnel, the detector surface can be uniformly

coated up to its rim. The material used must be able to withstand temperatures of up to 400°C, while keeping its shape.

The top view of Fig. 2 shows an uncoated annular area of the detector 2, which uncoated area is formed by being covered by the centering ring. The white surface areas represent the areas where the silicon resin layer 6 was burnt away. The black area represents the silicon resin layer, which has been deposited.

The significance of Fig. 3 as side view is evident.

With the method according to the invention, a surface of the TL detectors is provided with a silicon resin layer which is highly pigmented, adheres well on the crystal and has a thickness of about 30-50 µm, wherein the pigment consists of a black iron oxide, which is highly absorbing in the infrared light range. It is present in the mixture with a weight content of 50 - 60 %. The particle size of the pigments is about 2 - 4 µm.

As pigments furthermore aluminum particles, mica and talcum, zinc dust or iron mica can be used.

The pigmented silicon resin is applied by well-known paint spray procedures wherein the viscosity of the silicon resin is reduced by means of suitable solvents in order to achieve a homogeneous layer 5 of uniform thickness.

The detectors can be accommodated in a magazine-like holder, which has a capacity of about 250 detectors and which provides access only to the top surfaces of the detectors. The holder is manufactured specifically for that purpose for accommodating most working steps. The retaining structure can be so designed that it can be used in connection with standard laser imprinting systems.

After one of the end surfaces of each detector has been spray-coated, the previously admixed solvent is evaporated to about 99% in an exhaust air annealing furnace at about 100°C in

15 minutes. In this way, the silicon resin layer is also pre-tempered.

The detectors are marked using a standard laser imprinting system, wherein the pigmented silicon resin layer is burned away in accordance with the code pattern down to the detector surface without damaging this surface. In this way, a high contrast black-white pattern is formed.

With the use of a holder, the detectors are removed before the final tempering in order prevent them from being firmly attached to the holder and to largely prevent the coded surfaces from being damaged.

The final tempering of the matrix in which the pigments are dissolved occurs at a detector material-dependent temperature of between 170°C and 400°C over a period of about 30 min.

In this way, an optimal resistance to mechanical damage is obtained.

Listing of reference numerals:

1 cover plate

2 detector

3 base plate

4 mounting screw

5 silicon resin layer

6 burnt-away silicon resin layer

Patent claims

1. A thermoluminescence detector having a coded cover layer, characterized in that
a) the cover layer consists of a silicon resin having pigment particles finely distributed therein, wherein the layer thickness is between 30 to 50 µm and
b) the code is generated by quantitative evaporation of areas of the cover layer by means of a laser in accordance with a selectable pattern.

2. A thermoluminescence detector according to claim 1, characterized in that the pigment particles are black iron oxide particles with a particle size of between 2 - 4 µm.

3. A thermoluminescence detector according to claim 1 or 2, characterized in that the pigment content in said cover layer by weight is between 50 and 60 %.

4. A method for the manufacture of thermoluminescence detectors with a coded cover layer, comprising the following method steps:

a) coating thermoluminescence crystals with a pigmented silicon for example by spray painting,

b) pre-tempering the applied cover layer at about 100°C for 15 min whereby a large part the solvent needed for the spray painting is evaporated from the cover layer,

c) coding the cover layer by almost quantitative vaporization of areas of the cover layer by means of a laser in accordance with a selectable pattern, and

d) tempering the coded cover layer at a temperature of 170 - 400°C.

5. A method according to claim 4, characterized in that thermoluminescence crystals are held by a retaining structure in an orderly two-dimensional array and are removed from said retaining structure before final tempering.

ABSTRACT

The invention relates to a thermoluminescence detector and a method for production thereof. The aim of the invention is to develop a detector and a method for the direct inscription of the detector providing for a heat-resistant permanent marking of the detector. This is achieved by a cover layer consisting of a silicon resin including pigment particles finely distributed therein, wherein the layer thickness is between 30 and 50 µm and the marking is formed by an almost quantitative evaporation of areas of the cover layer by means of a laser in a selectable pattern.